

EFFECTS AND LIMITS OF PARTIAL BODY COOLING FOR WORK IN HOT-DRY CLIMATES

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Increasingly stressful ambient climates, changed working **tasks**, and higher demands on the working conditions require application **of** air conditioning measures at many workplaces. In that regard, clothing garments are gaining greater importance for technological and economic reasons. The severe climate *in hot dry salt works* ($T > 40^{\circ}\text{C}$ and $\phi < 30\%$) **has** provided motivation for intensive and thorough field tests, *in addition to tests in climate chambers*, with **different cooling garments** (water/ice and dry ice vests, liquid cooled vests and helmets, and vortex tube cooled vests).

During these **tests**, the principal points of interest have been the technical design of the cooling garment **and** the relief they provide **from** thermal *stress* for **two** conditions: (1) during work of several hours duration (application period < 3 hours, T of 40 to 55°C , $\phi < 30\%$, and $\text{BEU} < 300$ Watts), and (2) for short-term operation of the **mine** rescue corps (application period < 2 hours, T of 40 to 60°C , $\phi < 30\%$, and $\text{BEU} < 300$ Watts).

The principal test results are:

- For **all** conditions tested, the application of partial body cooling results in significant stress reduction (pulse frequency, temperature of the interior of the body, and sweat rate).
- A liquid-cooled helmet/vest combination provided the largest stress reduction and the greatest wearing comfort for normal work in a hot workplace.
- Water/ice filled vests are the most suitable cooling garments for use in industrial workplaces that require the employees to have freedom of movement.
- Air conditioned protective clothing provides **no real** alternative for air conditioning at industrial workplaces due to extensive technical requirements and the low efficiency of such systems.

The following notable limits and marginal conditions are applicable to use of partial body cooling in hot **dry** environmental conditions:

- With respect to stress reduction, there **are** climatic upper and lower limits of effectiveness for partial body cooling systems.
- When using ice vests, the lower the thermal-work *stress* the larger the psychological *reservations* of wearers.
- Cooling only the head during longer periods of work in hot places ($T > 50^{\circ}\text{C}$ and $\phi < 30\%$) results in false control of thermoregulation.
- The application of cooling garments during operation of the mine rescue corps is strongly influenced by the physical condition of the men.
- Extension of the work **period** during mine rescue operations in extreme environmental conditions causes new problems (inspiratory conditions and cooling) for self-contained breathing apparatus.